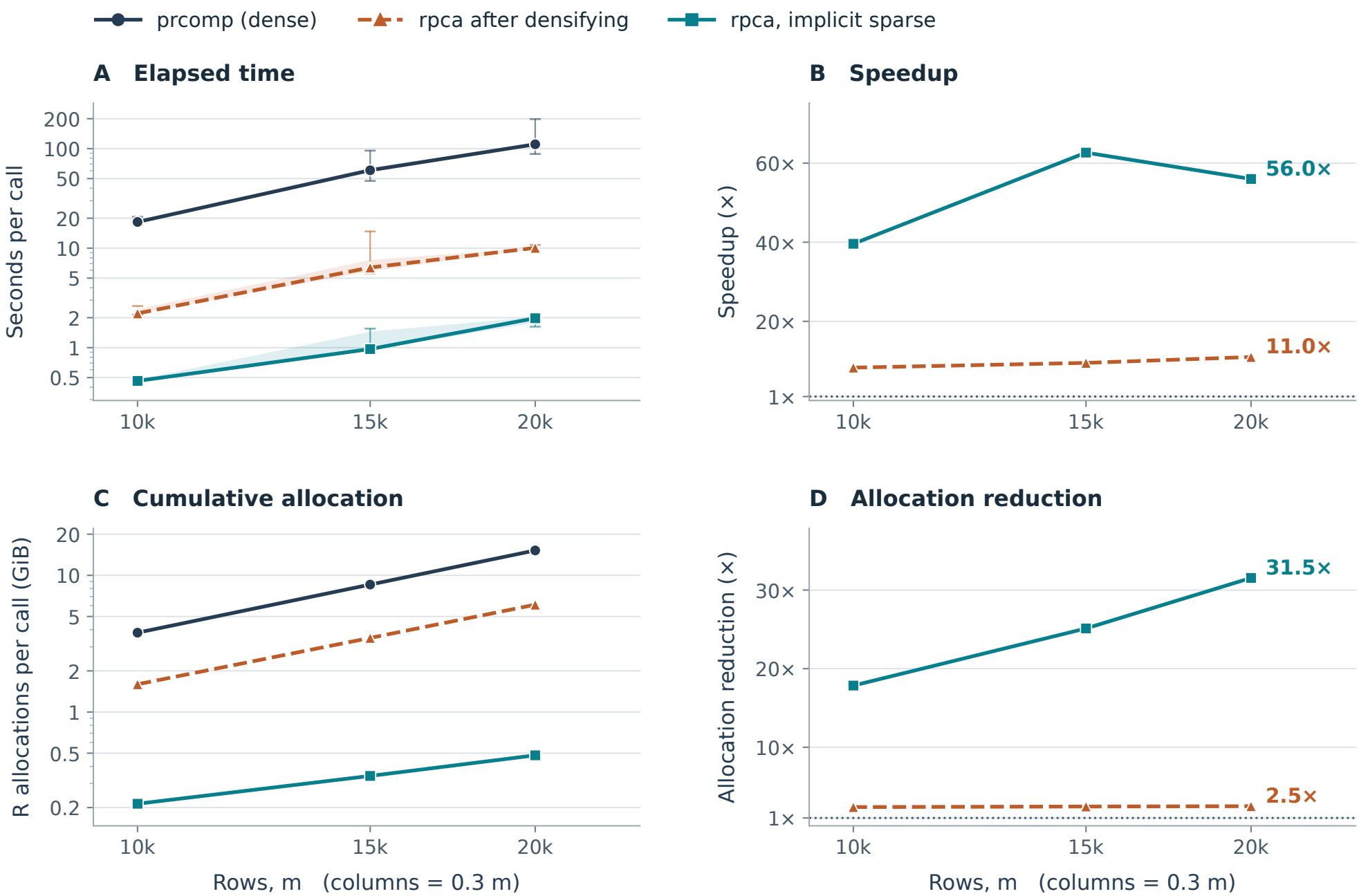
PCA on sparse input: preserving sparse storage

1.5–6 million nonzeros (5%); same preprocessing and 40 score columns



k = 40, p = 10, q = 2 · 5 calls per method · 4 BLAS threads · reference: prcomp

Time: medians, IQR bands, min–max whiskers. Speedup is the ratio of timing medians.

Ratios = reference / method; 1× means equal cost. Allocations: one R profile each, not peak RSS.

Largest observed residual / optimal rank-40 residual: 1.000001. Setup is excluded.